the law expressing the variation of the rotation corresponding to the deviation of the refracted ray, when the inclination of the planes of polarization to the plane of incidence is 45°; namely, that the cotangent of the inclination of the plane of polarization to that of refraction, is equal to the cosine of the difference between the angles of incidence and refraction. This formula represents the experiments so accurately, that when the analysing rhomb of calcareous spar is set to the calculated angle of inclination, the extraordinary image completely disappears; a result which is the strongest test of the correctness of the formula.

In order to determine the quantity of polarized light in the refracted pencil, the author follows a method similar to that which he employed for the reflected rays, and which he has explained in his former paper. He deduces as a general result, that the quantity of light polarized by refraction can never be mathematically equal to the whole of the transmitted pencil, however numerous be the refractions which it undergoes; or, in other words, refraction cannot produce rays truly polarized, that is, with their planes of polarization parallel. The same conclusions as were deduced in a preceding paper, respecting the partial polarization of light by reflexion, hold good with regard to similar changes produced by its refraction. Each refracting surface produces a change in the position of the planes of polarization, and consequently a physical change upon the transmitted pencil by which it has approached to the state of complete polarization. This proposition the author illustrates by applying the formulæ to the results of actual experiment, and showing their coincidence.

By prosecuting this investigation, the author arrives at the following important laws, namely, that at the first surface of all bodies, and at all angles of incidence, the quantity of light polarized by refraction is equal to the quantity polarized by reflexion; and also that the reflected is equal to the transmitted light when the inclination of the planes of polarization of the reflected pencil to the plane of the reflexion is the complement of the inclination of the planes of polarization to the same plane.

On the Action of the Second Surfaces of transparent Plates upon Light. *By* David Brewster, *LL.D. F.R.S. L. & E.* Read February 25, 1830. [*Phil. Trans.* 1830, *p.* 145.]

M. Arago had conceived that he had proved by an experiment, that at every possible angle of incidence the quantity of light polarized by reflexion was precisely equal to that of the light at the same time polarized by refraction. Dr. Brewster shows in the present paper, that the experiment does not warrant this conclusion; as the phenomena observed from it are the complicated effects of various refractions and reflexions from both surfaces of the glass, each affecting the position of the planes of polarization. By varying the form of the experiment in a way which allowed of the observation of these effects when separate, he is led to the following general law; namely,

that a pencil of light reflected from the second surface of a transparent plate, and reaching the eye after two refractions and an intermediate reflexion, contains, at all angles of incidence, from zero to the maximum polarizing angle, a portion of light polarized in the plane of reflexion. Above the polarizing angle, the part of the pencil polarized by reflexion diminishes until the cosine of the sum of the angles of incidence and reflexion equals the cube of the cosine of the difference between these two angles, when it disappears, and the whole pencil has the character of common light. Above this last angle, the pencil contains a quantity of light polarized perpendicularly to the plane of reflexion, which increases to a maximum, and then diminishes to zero, when the angle has attained 90°. The effect of the two refractions in M. Arago's experiment, was to make the two quantities of light appear equal, when in fact the one was exactly double of the other.

The paper concludes with formulæ and tables for computing the exact quantities of polarized light at all angles of incidence.

Observations made with the Invariable Pendulum (*No.* 4. Jones), *at the Royal Observatory, Cape of Good Hope, for the purpose of determining the Compression of the Earth. By the Rev.* Fearon Fallows, *F.R.S. Astronomer of the Cape Observatory. Communicated by the Lords Commissioners of the Admiralty.* Read February 18, 1830. [*Phil. Trans.* 1830, *p.* 153.]

Of the two methods employed for determining the figure of the earth, namely, the direct measurements of arcs of the meridian, or of ascertaining the variations in the length of the seconds pendulum in different places, the author remarks that the former is attended with the collateral benefit of fixing the geographical position of certain stations in the country surveyed; but the latter possesses the advantage of enabling the observer to concentrate, under his own immediate eye, the results of his inquiries. The Observatory at the Cape of Good Hope having been furnished by the Lords Commissioners of the Admiralty with the invariable pendulum of Jones, which had for several years been strictly examined by Capt. Sabine, the author was anxious to begin a series of experiments with it; and as it was not likely that the observatory would be completed for a considerable time, he caused a strong brick pier to be built in an adjoining outhouse for the support of a transit instrument, the same which he had used in forming his catalogue of southern stars. He gives a detailed account of his mode of fitting up the clock, and other parts of the apparatus necessary for the pendulum experiments. He was ably assisted by Capt. Ronald and Lieut. Johnson, who took an active part in all the observations. He remarks, that the near agreement of the three independent series of observations, made by himself and these two gentlemen, and which accompany the paper, is no small argument in favour of their accuracy. The difference in the number of vibrations of the seconds pendulum at the Cape, from that